B.Tech. Civil (Construction Management) /
B.Tech. Civil (Water Resources Engineering) /
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Term-End Examination

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ET-101(B) : MATHEMATICS – II

(PROBABILITY AND STATISTICS)

Time : 3 hours   *Maximum Marks : 70*

Note : *All questions are **compulsory**. Use of calculator is allowed. Use statistical table wherever necessary.*

1. Answer any *six* of the following :   6×5=30

    (a) A bag contains 5 blue and 8 green balls. Two draws of 3 balls are made with replacement. Find the probability that the first draw will give 3 blue balls and the second 3 green balls.

    (b) If A and B be events with $P(A) = \dfrac{1}{3}$, $P(B) = \dfrac{1}{4}$ and $P(A \cup B) = \dfrac{1}{2}$, find (i) P(A/B); (ii) P(B/A).

    (c) A box contains 4 bad and 6 good tubes. 2 tubes are drawn out from the box at a time. One of them is found to be good. Determine the probability that the other one is also good.

(d)　In a bolt factory there are four machines A, B, C and D manufacturing 20%, 15% and 25%, 40% of the total output respectively. Of their outputs 5%, 4%, 3% and 2% in the same order are defective bolts. A bolt is chosen at random from the factory's production and is found to be defective. What is probability that the bolt was manufactured by machine A or D ?

(e)　The police plans to enforce speed limits by using radar traps at 4 different locations within the city limits. The radar traps at each of these locations L_1, L_2, L_3 and L_4 are operated for 40%, 30%, 20% and 30% of the time. If a person who is speeding on his way to work has probability of 0·2, 0·1, 0·5 and 0·2 respectively of passing through these locations, what is the probability that he will be fined (for over speeding) ?

(f)　A discrete random variable X has the following distribution function.

X :	1	2	3	4	5	6	7
P(X):	0·05	0·1	0·2	0·2	0·3	0·1	0·05

Determine E(X) and V(X).

(g) The incidence of occupational disease in an industry is such that the workmen have 10% chances of suffering from it. What is the probability that in a group of 7, '5 or more' will suffer from it?

(h) Suppose that on an average 1 house in 1000 houses gets fire in a year in a district. If there are 2000 houses in that district, find the probability that exactly 5 houses will have fire during that year.

2. Answer any *two* of the following: $2\times10=20$

(a) A normal curve has mean $\bar{x} = 20$ and the variance = 100. Find the area between x = 26, x = 38 and also between x = 15 and x = 40.

(b) In a factory producing nuts and bolts, a machine produces both, a fraction of which are defective. A sample of 400 bolts is collected and of these 30 are found defective. The manufacturer claims that it produces not more than 5% defective bolts. Find the 95% confidence limits of the proportion of the defective bolts.

(c) In a school an I.Q. test was given to a group of boys and to a group of girls. The scores are as follows:

	Size	Mean Score	S.D.
Boys	60	75	8
Girls	100	73	10

3. Answer any *two* of the following :   *2×10=20*

   (a)   A sample of 20 items has mean 42 units and standard deviation 5 units. Test the hypothesis that it is a random sample from a normal population with mean 45 units.

   (b)   A die is thrown 276 times and results of these throws are tabulated below :

No. on the die	1	2	3	4	5	6
Frequency	40	32	29	59	57	59

Test if the die is unbiased using χ^2 test.

   (c)   A lot contains 100 articles of which 10 are defective. The lot is rejected if a random sample of 10 articles drawn from the lot contains more than 2 defective. Use normal approximation to compute the probability that the lot is accepted.

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